Resource Action: EWG – 26	**Task Force Recommendation Category: 2**

Fish Habitat Enhancement in the Thermalito Afterbay

Date of Field Evaluation: N/A

Evaluation Team: Eric See

Description of Potential Resource Action:
This Resource Action is designed to enhance the structural complexity of the Thermalito Afterbay littoral zone for the benefit of game fish such as largemouth bass, redear sunfish, bluegill, and channel catfish that use these areas for spawning, rearing, and foraging. This project would also benefit the growth of salmonids if they are eventually stocked in the Afterbay, by increasing invertebrate production. This project would be accomplished by constructing reefs using Christmas trees, logs, or other large woody debris or plastic materials, weighted pipes, and may also entail planting water tolerant vegetation such as bulrush. This project would be similar to EWG 31, which proposes to enhance the fish habitat at Lake Oroville. This project would be implemented using an "adaptive management" approach, and would occur in 5-year phases. This Resource Action describes the first 5-year phase.

The following resource actions are either similar to or directly related to the proposed measure:

- EWG-28, manage water levels in the Thermalito Afterbay aimed at protecting nesting and rearing warm water species (i.e., bass)
- EWG-31, Lake Oroville Fish Habitat Enhancement
- EWG-45, create trophy salmonid stocking program in Afterbay
- EWG-47, stock salmonids in the Oroville Wildlife Area
- EWG-48, stock warm water fish (largemouth bass) in the Oroville Wildlife Area

Nexus to Project:
- Water level fluctuations hinder the establishment of rooted aquatic vegetation, which reduces the amount of littoral zone structure used by cover-dependant game fish for spawning, rearing, and foraging
- Water level fluctuations can negatively impact fish spawning by dewatering nests, or causing rapid temperature changes which can affect egg development and/or lead to adult nest abandonment
- Water level reductions may dewater large portions of the littoral zone, pulling cover-dependent juvenile game fish (e.g. largemouth bass) from protected nursery areas to open, exposed areas, which increases predation on these fish

Potential Environmental Benefits:

- The primary intended benefit is increasing the habitat complexity in the Thermalito Afterbay. This increases the amount of micro-cover for juvenile game fish and will reduce the rate of predation, which can result in increased year-class strength. In addition, the total amount of surface area for periphyton attachment is increased which may increase levels of productivity, benefiting both juvenile game fish, and forage fish production which can also enhance adult warm water and coldwater game fish populations
- Largemouth bass prefer nesting near cover such as rocks, stumps, sunken trees, aquatic vegetation, submerged brush, etc.
- Littoral zone structure can reduce the erosive effects of wave action, decreasing impacts on game fish nests, as well as reducing reservoir turbidity in the habitat enhancement areas
- Aquatic and terrestrial wildlife (e.g., amphibians, reptiles, birds) also derive benefits from an increase in the structural complexity of the fluctuation zone through increased cover and foraging
- These projects are very well received by the local public and generate a significant amount of positive public relations for DWR

Potential Constraints:

Potential constraints associated with this Resource Action could include:

- Navigational/swimming hazards
- The extent and duration of water level fluctuations will affect the survival of rooted vegetation and thus limit the areas where they can be planted

Existing Conditions in the Proposed Resource Action Implementation Area:

At 4300 surface acres, the Thermalito Afterbay is the second largest reservoir in Butte County. It is a shallow reservoir with gently sloping banks and depths that rarely exceed 20 ft., with vast areas of flooded aquatic vegetation in its upper margins. It's function as a re-regulating reservoir for Lake Oroville power production, as well as a temporary storage pool for pump-back operations, results in frequent water surface fluctuations that can occur on a weekly, or even daily basis. The operational fluctuation range is rated at 12 feet, however the Afterbay's normal fluctuation range is about 4-8 feet. This fluctuation regime, combined with the Afterbay's shallow sloping shoreline, has created conditions at the Afterbay where thick, abundant flooded vegetation occurs at or above the elevation of approximately 128 ft., however this vegetation ends abruptly below this elevation, changing to open mud and sand flats, providing very little cover for gamefish (Figure 1). Conditions such as this have been related to observed declines in standing crops of centrarchid species (e.g., black bass, sunfish) as a result of reduced food availability and higher predation on young-of-year fishes (Brouha and Von Geldern 1979).

Although structure in the littoral zone is limited at the Thermalito Afterbay, spawning substrates such as clay, sand, and small gravel, which are preferred by gamefish

species such as largemouth bass, bluegill, and redear sunfish are relatively abundant. Therefore, spawning substrate enhancement is unnecessary for these species, however this is not the case with channel catfish. Channel catfish prefer to spawn in ”cave-like” sites in undercut banks, large root wads, log jams, under large rocks, and other protected sites. This type of habitat is limited at the Afterbay, occurring only along portions of the exposed rocky surface of the Afterbay dam, which is not an ideal location for channel catfish, which prefer more secluded locations away from exposed areas of high winds and significant wave action, such as in the back of secluded coves and small bays. Therefore, channel catfish spawning structures will be included as a component of this resource action.

Design Considerations and Evaluation:

This Resource Action involves 3 different types of habitat enhancement projects, reef construction (e.g. brush shelters), the planting of water tolerant vegetation (bulrush and/or cattails), and channel catfish spawning structures.

Reef Construction

Reefs will be constructed within selected coves of the Afterbay fluctuation zone and in the deeper water of the minimum pool immediately adjacent to the fluctuation zone, providing areas of micro-cover during all water level configurations.

Reefs constructed of brush, commonly referred to as brush shelters, are an effective way to provide micro-cover. They consist of various materials including discarded Christmas trees (Figure 2), trees/brush cut from orchards or upland habitats in the local area (Figure 3), and plastic structures designed specifically for fish habitat. The brush shelters will be anchored to the lakebed using steel fence posts, concrete blocks, or other suitable materials, to keep the brush shelters from floating away. Typically brush shelters are built as separate units covering 150 to 400 ft^2 of lakebed and are installed in clusters. They will be located in coves and protected bays that are common spawning areas for largemouth bass, redear sunfish, and bluegill. Projects will be targeted in the elevation range of approximately 120’ to 126’ to provide fishery benefits at a variety of lake levels, including the minimum pool of 124’. A review of historic as well as proposed fluctuation regimes will be conducted to confirm the appropriate elevation range for these projects, in order to ensure that cover will be available throughout the spring and summer spawning and rearing periods. Evaluation of site-specific conditions such as slope, exposure, access, proximity to boating/swimming areas, wildlife management projects (e.g. brood pond construction) and other factors will determine the specific placement and types of structures. For boating safety purposes, warning buoys may be installed in the project areas. Current locations identified (others may be identified):

- Cove near the Monument Hill Boat Ramp
- Cove on north end of Afterbay near the Tres Vias and Potter brood ponds.
- Shallow bay on north end of Afterbay near Western Canal outlet
- Bay at the end of South Wilbur Road (safe distance away from existing water ski course)

- Bay northwest of Larkin Road Boat Ramp)

Construction of brush shelters would be implemented on an annual basis, and the target amount would be the equivalent of approximately one hundred 30 ft² brush shelters that stand 3-4 ft. high. The exact size and shape would be vary with the material used, it is difficult to assign specific sizes and amounts with brush shelter projects because they differ so much in their design based upon the materials used and the conditions at the site. However this target should provide an approximate annual goal for these projects.

These projects are very popular with the local public. Many different local groups have volunteered to assist DWR in its current brush shelter activities at Lake Oroville, including the Boy Scouts of America, local fishing clubs, schools, and private citizens. This Resource Action will continue this tradition of working with the public on these projects, and the extent of the projects in a given year may be expanded based upon the level of local volunteer involvement.

Flood Tolerant Vegetation

Naturally occurring stands of bulrush (*Scirpus acutus*) a California native species, presently occur in some areas of the Afterbay, providing useful habitat for juvenile gamefish, as well waterfowl and other wildlife. The Department of Fish and Game has suggested increasing the amount of bulrush around the Afterbay for wildlife benefits, and this would also enhance fish habitat. Bulrush would be transplanted either by hand or with the use of heavy equipment, in selected locations around the Afterbay with suitable soil and hydrology. Additional information will need to be gathered from the Department of Fish and Game in order for this project to proceed.

Channel Catfish Spawning Structures

As previously mentioned, channel catfish prefer to spawn in secluded, ”cave-like” locations. This project would primarily involve the placement of 3-4 ft. sections of 9-18 in. diameter concrete and PVC pipe, which makes excellent spawning habitat. Other materials may be substituted for concrete and PVC pipe based on availability, including scrap pieces of culvert, steel pipe, buckets, and other discarded items found around the Oroville Field Division. Rock rubble and other materials that create similar cavities may also be used. These “pipe-caves” would be placed in the same areas and elevations identified for brush shelters. Due to the territorial behavior of male channel catfish during the spawning season, the pipe-caves would be placed at least 40 ft. apart to reduce fighting among males (Lee and Gleason, 1989).

A target of 100 3-4 ft. pipe-caves would be installed each year, which would cover approximately 4 acres of lakebed.

Project Summary

The following is a summary of the projects in this Resource Action, they would be implemented annually over a 5-year period, at that time an evaluation for continuing this Resource Action for another 5 years would be considered along with potential alterations. These are estimates and may vary ±15%)

100 brush shelters
100 Channel Catfish Spawning Structures
Bulrush transplants to be determined
Construction of rock reefs if waste material can be acquired (number of reefs will be based on amount of available material, total would be similar to that of brush shelters)

Environmental permitting requirements may include:

CEQA
DFG 1601
ACOE 404
CWA 401

A monitoring program of the effects on the fishery could include springtime snorkel surveys and/or electrofishing to assess fish species composition, abundance, and size structure in the habitat enhancement areas. This would be used to confirm utilization of these projects by the target fish species such as black bass and channel catfish, and better hone the planning and implementation of future projects (brush shelter design, pipe-cave design, site location, etc.) Fish population monitoring could also be conducted to identify the overall effect on the fish production, however these analyses require a much higher level of effort and are more expensive, possibly exceeding the cost of the enhancement projects. This monitoring could be incorporated into Afterbay fishery monitoring for other Resource Actions or studies by other agencies.
Monitoring the projects themselves would involve recording the date of implementation and location of the projects (structures, bulrush stands, pipe caves, etc.) and then checking them over time. Periodic revisions in structure design may be necessary to increase their durability and/or effectiveness. Survival of bulrush stands would be recorded to monitor success in the various areas and this information will be used to identify better methods and sites for future plantings.

Synergism and Conflicts:

Synergisms could be created if this measure is planned in conjunction with other Resource Actions designed to enhance the Afterbay fishery such as fish stocking (EWG-45 and EWG-48). In addition, efforts to increase the presence of bulrush by the Department of Fish and Game for wildlife species would also be synergistic, as would EWG-67 which involves replacing nonnative plants with native species, some of which may provide habitat for fish such as *Juncus* spp. This Resource Action is synergistic

with the development of a recreational fishery management plan since it would primarily benefit the Afterbay recreational fishery.

A potential conflict would be with boat navigation and swimming, depending upon where these projects were constructed. This would be kept in mind when determining the location and design of the structures to be installed; certain projects (e.g., brush shelters, rock rubble) may not be implemented near swimming areas or high boat traffic areas of the lake. Warning buoys and/or signs would be considered. In addition, a potential conflict may exist with giant garter snakes and red-legged frogs. These fish habitat projects are designed to increase the production of gamefish such as largemouth bass which is known predator of these two special status species (Federal and State threatened, Federal threatened, respectively). Although these species have not been found at the Afterbay, suitable habitat does exist. The USFWS will be consulted on this issue, now and in the future if these special status species are found at the Afterbay.

Uncertainties:

The main uncertainty associated with this Resource Action would be determining the level of success of the various projects. Monitoring may indicate increased fish utilization of these areas, however it will be difficult to determine if this is related to increased production, or a result of fish being attracted to these areas. In addition, the fluctuation regime, water temperatures, weather patterns, and many other environmental factors that are difficult to quantify may affect the numbers of fish in a given year and mask the impact of this Resource Action.

Cost Estimate (Annual):

100 brush shelters : $20,000
100 Channel Catfish Spawning Structures: $3500
Monitoring: $1500 - ?
Annual Total: ~$25,000 (with review after 5 years)

Recommendations:

This Resource Action should be considered as an alternative for mitigating the potential negative effects of project operations on game fish at the Thermalito Afterbay. In addition to fishery benefits, these projects can provide benefits for wildlife and are well regarded by the local public, providing the opportunity for outreach programs with local organizations such as the Boy Scouts of America, fishing organizations, and area schools.

Literature Cited:

Brouha, P. and C.E. Von Geldern. 1979. Habitat manipulation for centrarchid production in western reservoirs. pp. 11-17 *in* D.L. Johnson and R.A. Stein, editors. Response of fish to habitat structure in standing water. North Central Division American Fisheries Society Special Publication 6.

Lee, D.P. and E. Gleason. 1989. Warmwater reservoir fish habitat improvement techniques. California Department of Fish and Game, Inland Fisheries Informational Leaflet, Number 42. 29 pp.

Figure 1. Afterbay Cove at minimum pool elevation of 124 ft.

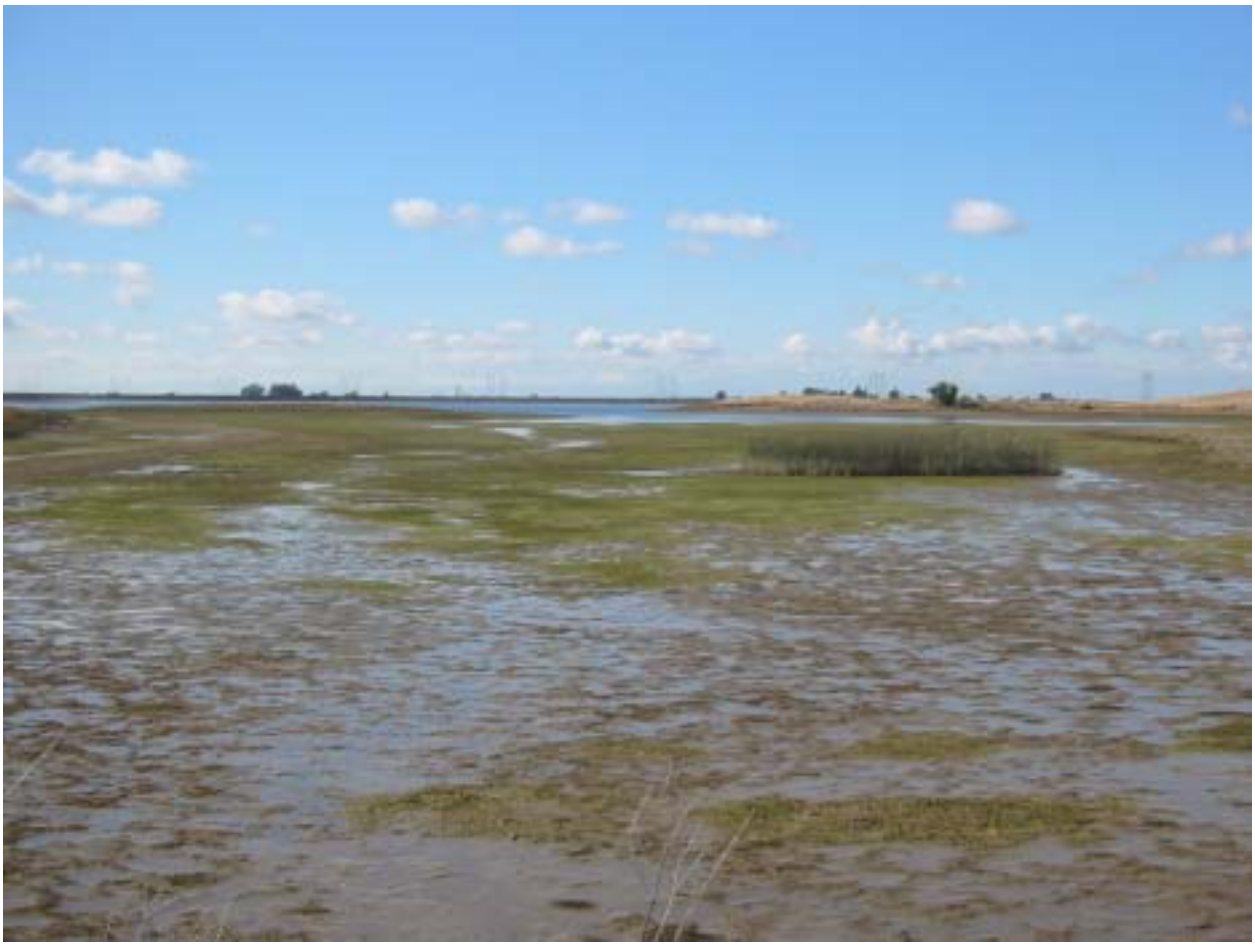

Figure 2. Christmas Tree Brush Shelters (Lake Oroville)

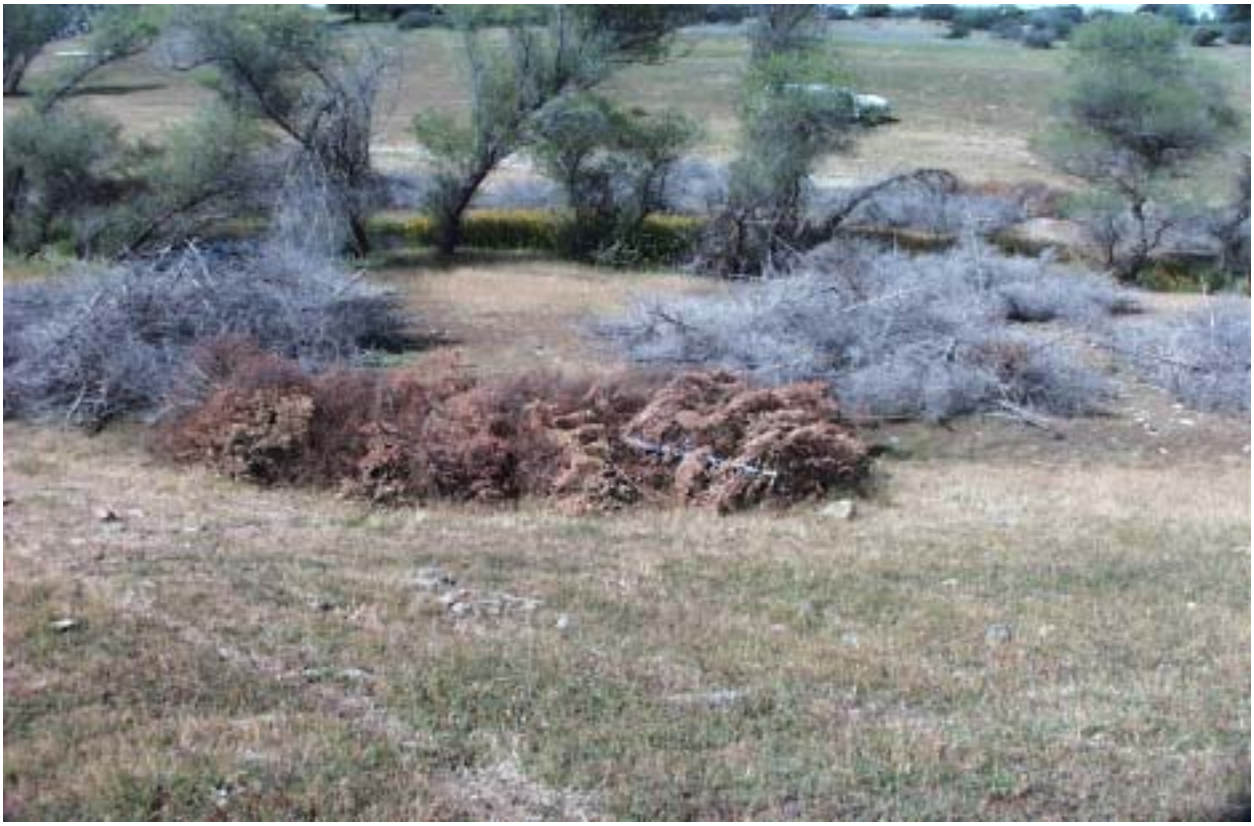

Figure 3. Manzanita Brush Shelter (Lake Oroville)